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A Hazard Identification Framework of Complex Systems

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Abstract

A chemical process facility is a highly complex system. The interactions among a small group of the functions, such as process, equipment, human, organizational functions, could split, merge or couple leading to a complex non-linear system. The hazards brought by the tight coupling and nonlinear interaction of the functions are not so obvious to observers and may cause an unexpected incident without adequate prior indications.

A few number of socio-technical models have been developed in the recent years for complex systems, but their applications in the chemical industry are still limited. The objective of the current study is set to develop a framework to identify hazards present in a complex chemical process in terms of deviations of the functions. One of the socio-technical models, Functional Resonance Analysis Method (FRAM), has been used as a basic tool to understand the interaction of the functions that are involved in a chemical process. Process kinetics model, equipment reliability model, and human reliability model have been integrated on the basic structure of FRAM to develop the framework. Hazards corresponding to different interactions among the functions will be identified by stochastic simulation.

Keywords: hazard identification, socio-technical system